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25 January 2019

Melanie Morash
Remedial Project Manager
U.S. Environmental Protection Agency
Region 9
75 Hawthorne Street (SFD-7-1)
San Francisco, CA 94105

RE: Response to EPA Comments Received 18 September 2018 Regarding Five-Year Status Report and Remedial Effectiveness Evaluation 2011 to 2015
811 East Arques Avenue Site, Sunnyvale, California

Dear Ms. Morash:

This letter is submitted on behalf of Philips Semiconductors Inc (Philips) in response to the comments received on 18 September 2018 with regard to *Five-Year Status Report and Remedial Effectiveness Evaluation 2011 to 2015* (Five-Year Report) dated 17 June 2016 for the 811 East Arques Avenue Site in Sunnyvale, CA. Original EPA comments are restated in *italics*; responses to comments follow. Responses are consistent with the 17 October 2018 conference call between EPA, Philips, and Locus regarding the intent to incorporate the comments, as applicable, into the subsequent Five-Year Report (2016-2020) to be submitted in 2021 rather than revising previously issued reports. Additionally, in light of EPA comments received on 21 December 2018, future Five Year Reports for the OOU and Signetics sites will be combined into a single report. Philips has reviewed the RWQCB Order and agrees that a single report will continue to be in compliance with the requirements of the Order. Philips would like to request that EPA maintains the separation of oversight tracking and allocates the portions appropriately to either Signetics or OOU.

1.0 General Comments

General Comment 1: *The Report was submitted in accordance with Provision C.41, Task 11 of the Order. Remedial action objectives (RAOs) were not presented or discussed from which remedial progress can be evaluated. Please revise the Report to address RAOs. Accordingly, remediation effectiveness is inferred to be evaluated with reference to regulatory levels associated with potential human health risk resulting from ingestion of groundwater (Maximum Contaminant Levels [MCLs]). VI is recognized as a primary potential human health risk during the 2011-2015 reporting period, yet VI criteria were not incorporated into evaluation of remedial effectiveness. Please revise the Report to incorporate VI criteria in the evaluation.*

Response: These items will be addressed in forthcoming Five-Year Reports, beginning with the 2016-2020 Five-Year Report.

General Comment 2: *The evaluation of remedial effectiveness at the Signetics Site should be restricted to data generated on, or immediately adjacent to, the Signetics Site. Data generated from wells far removed from the Signetics Site are not appropriate for evaluation of the Signetics Site. In addition, site boundaries should be depicted in the report figures. Please revise the Report to address these items.*

Response: The evaluation of remedial effectiveness at the Signetics Site will include data from the groundwater wells within or relevant to the Signetics site boundary only, and will exclude those in the northern portion of the OOU site, beginning with the 2016-2020 Five-Year Report.

General Comment 3: *The evaluation of remedial effectiveness should include detailed discussions of progress towards RAOs. The duration of the groundwater remedy outlined in the Order was 24 years to attain remediation goals in groundwater beneath the Signetics Site, which have been surpassed by cleanup operations without attainment of goals. The recommendation to evaluate enhanced anaerobic biodegradation as a remedy is not justified on the basis of the remedial effectiveness results presented in the Report that indicate the vertical hydraulic gradients are acceptable, capture zones are adequate, the mass removal rate is steady, trichloroethene (TCE) concentrations in groundwater are decreasing, and plume boundaries are stable (see the following comments). Please revise the Report to add robustness to the discussion of ISB as a potential remedy change by expanding upon the discussions of vertical hydraulic gradients, capture zones, mass removal rates, concentration trends, and shifts in plume boundaries.*

Response: Beginning with the 2016-2020 Five-Year Report, five-year reports will include findings from the most recent annual capture zone and vertical gradient evaluation (refer to EPA comments and Locus responses to the 2017 Annual Report with respect to these annual analyses). Ultimately, findings from these analyses in combination with TCE mass removal, concentration, and plume boundary trends will inform a more robust discussion of remedial evaluation, including discussion of *in situ* bioremediation as a potential remedy change.

General Comment 4: *The Field Sampling and Analysis Guidance Manual (The Gauntlett Group, 1998) should be updated to account for changes in sampling protocol and laboratory analysis during the past 20 years, and provide updated RAOs to include potential VI concerns against which effectiveness can be compared.*

Response: An updated parent QAPP is under preparation consistent with current EPA guidance and to be submitted on forthcoming QAPP and SAP deadlines in the imminent AOC and SOW for the Signetics site. An SAP consistent with current EPA guidance will also be delivered on the forthcoming AOC/SOW schedule.

2.0 Specific Comments

Specific Comment 1: *Section 2.4, Page 4, First Paragraph – The stratigraphic information presented in the Report references cross-sections generated over 20 years ago. The complexities of the various hydrostratigraphic units are not addressed. Understanding of the subsurface geology/hydrogeology is critical in understanding sources, residual sources, and migration pathways of contaminants that must be addressed to evaluate remedial effectiveness. Recent environmental stratigraphic studies generated at adjacent sites significantly affect the interpretation of deposits adjacent to, and beneath, the Signetics Site. The section on site hydrogeology should include an updated hydrogeologic discussion with reference to coarse-gained sediment preferred pathways and possible fine-grained residual sources and the results incorporated into subsequent discussions. Please revise the Report to address these issues.*

Response: Beginning with the 2016-2020 Five-Year Report the section that presents site hydrogeology will include a more thorough hydrogeologic discussion with reference to preferred pathways and possible residual upgradient sources.

Specific Comment 2: *Section 2.5.2, Page 5, Second Paragraph – The text in the Report states that groundwater monitoring is conducted to monitor remedial effectiveness and containment of the contaminant plume. Reduction in potential human health risk is critical in evaluating remedial effectiveness. In addition to the discussion on public water supply aquifers, please revise the Report to include potential VI concerns related to chemicals in groundwater.*

Response: Beginning with the 2016-2020 Five-Year Report, the subject paragraph will be revised to note the additional purpose of the groundwater sampling program, which is to track reduction in potential human health risk (in other words, reductions in COC concentrations towards the clean-up targets). As applicable throughout the report, groundwater concentration trends will be discussed in reference to clean-up targets established in the Orders. Additionally, Section 2.5 Nature and Extent of Chemicals at the Site will include a discussion of potential vapor intrusion concerns under investigation.

Specific Comment 3: *Section 3.1.2, Page 7 – This section of the Report provides a good description of the actions taken to address contaminants in the vadose zone by soil vapor extraction or dual-purpose extraction. Critical to the evaluation of the success of the vadose zone remedy is total mass removed and estimates of residual mass. Please revise the Report to provide estimates of these parameters.*

Response: SVE system data available from the period of operation (1988-1996) and associated reporting on the SVE system will be reviewed to provide best estimates of total mass removed and residual mass, estimates which will then be reported beginning with the 2016-2020 Five-Year Report.

Specific Comment 4: *Section 3.3, Page 11, First paragraph – Monitoring procedures, sampling procedures, and quality assurance/quality control objectives as referenced in the Field Sampling and Analysis Guidance Manual (The Gauntlett Group, 1998) should be updated to current standards with reference to current RAOs.*

Response: An updated parent QAPP including reference to current RAOs is under preparation consistent with current EPA guidance and to be submitted on forthcoming QAPP and SAP deadlines in the imminent AOC and SOW for the Signetics site. An SAP consistent with current EPA guidance will also be delivered on the forthcoming AOC/SOW schedule.

Specific Comment 5: *Section 3.3, Page 12, First Paragraph – The text in this section states that groundwater levels are monitored annually at 111 monitoring and extraction wells at the Signetics Site as detailed in Table 3-2. However, numerous wells listed in Table 3-2 are far removed from the Signetics Site and should not be included in the Report. Please revise the well list to include only those wells on, or immediately adjacent to, the Signetics Site.*

Response: In reference to the Signetics site, the report will discuss data from the groundwater wells within or relevant to the Signetics site boundary only, and will exclude from the discussion those in the northern portion of the OOU site, beginning with the 2016-2020 Five-Year Report.

Specific Comment 6: *Section 4, Page 14, First Paragraph (and Figures 4-1 through 4-4) – Please revise the vertical gradient analysis in the Report to use only those wells on, or immediately adjacent to, the Signetics Site.*

Response: The subject evaluation for the Signetics site will include data from the groundwater wells within or relevant to the Signetics site boundary only, beginning with the 2016-2020 Five-Year Report.

Specific Comment 7: *Section 4, Pages 14 and 15 (and Tables 4-1 through 4-5) – The data used to evaluate the vertical gradient for the "A", "B2", and "B4" aquifers in 2011 are from 2010 (Table 4-1). Similarly, for these aquifers, data presented in Tables 4-2 to 4-4 for 2012 through 2014 are not for the reporting periods. No data for 2015 was reported for these wells in Table 4-5. Please provide revised data consistent with the 2011 to 2015 reporting period.*

Response: Tables 4-1 through 4-5 entail water elevations gathered on the date noted in the respective table title. The most recent representative concentration from each well was used in the comparison, which may not be collected from the same time period. However, beginning with the 2016-2020 Five-Year Report, analytical data will only be incorporated if available from the most concurrent annual sampling event. In other words, in accordance with the annual water level event that occurs in October of each year, the vertical gradient evaluation will only include wells having analytical data from the fall of that same year (collected during the routine annual sampling event). The table titles and footnotes will be revisited to more clearly identify the dates of datasets used.

Specific Comment 8: *Section 4.1, Page 14, First Paragraph – The assertion that it is generally desirable for vertical hydraulic gradient to flow from a lower concentration to a high concentration is not valid for shallow groundwater that is potentially of VI concern. The vertical gradient evaluation should account for a reduction in concentration that may affect human health risk. An upward gradient in the two shallow hydrostratigraphic in areas where the "B1"*

aquifer exceeds Vapor Intrusion Screening Levels (VISLs) will not result in mitigating the source of VI concerns from the TCE-impacted "A" aquifer. Unilaterally, a downward vertical gradient is preferable for any portion of the "A" aquifer that contains contaminants above the VISL. Please revise the Report accordingly to account for potential VI concerns in the vertical gradient evaluation in shallow aquifers.

Response: Beginning with the 2016-2020 Five-Year Report, the "A/B1" Aquifer vertical gradient evaluation will uniquely discuss well pairs, in the context of hydraulic gradient desirability and vapor intrusion concerns.

Specific Comment 9: *Section 4.1, Page 15, First Paragraph – The text in the Report states that the direction of vertical gradient across the "A/B" aquitard is not of significant concern. Onsite wells S003A, S082A, and S157A are located in areas where the groundwater concentration of TCE in the "A" aquifer exceeds the commercial VISL for TCE and they exhibited an upward gradient during the reporting period. Also during the reporting period, the groundwater remedy has not significantly reduced concentrations in these three wells, and subsequently not reduced the potential VI concerns in these areas. Please revise the evaluation to address remedial effectiveness in relation to persistent elevated TCE concentrations as they relate to potential VI concerns.*

Response: Beginning with the 2016-2020 Five-Year Report, the "A/B1" Aquifer vertical gradient evaluation will uniquely discuss well pairs, in the context of hydraulic gradient desirability and vapor intrusion concerns.

Specific Comment 10: *Section 4.2, Page 15, First Paragraph – The capture zone figures referenced in Appendix C are based upon data generated up to 4,000 feet distance from the Signetics Site. A more detailed graphic presentation of the capture zone analysis of the Signetics Site is warranted. In addition, as stated in the Order, one of the primary purposes of the implemented groundwater remedy was to control migration of polluted groundwater from the OU. Please revise the Report to address the effectiveness of downgradient control in the various hydrostratigraphic units in the capture zone evaluation and potential changes in extraction rates.*

Response: Beginning with the 2016-2020 Five-Year Report, five-year reports will entail findings from the most recent annual capture zone analysis (refer to EPA comments and Locus responses to the 2017 Annual Report with respect to this analysis). Capture zones will be calculated, mapped, and discussed annually, beginning with the 2018 Annual Report, and in accordance with EPA's 2008 guidelines. Ultimately, findings from these analyses will inform a more robust discussion of plume capture and, if applicable, planned changes in extraction rates.

Specific Comment 11: *Section 4.4, Page18, First Paragraph – In regards to concentration trends, please use only data generated on, or adjacent to, the Signetics Site and revise the discussion and data presented in Tables 4-7 and 4-8.*

Response: In reference to the Signetics site, the subject evaluations will include data from the groundwater wells within or relevant to the Signetics site boundary only, beginning with the 2016-2020 Five-Year Report.

Specific Comment 12: *Section 4.4.1, Page 18, First Paragraph – The data presented show a significant reduction in the geometric mean of the "A" aquifer since inception of the groundwater remedy in onsite wells. However, the decrease in average geometric mean concentration of TCE during the reporting period appears to be leveling off during the reporting period and may be approaching asymptotic levels significantly above the commercial VISL. A subsequent discussion is warranted as to the remedial effectiveness and time period to achieve levels protective of VI concerns and MCLs, especially since the remedy has operated longer than initially scheduled. Please revise the Report accordingly.*

Response: Beginning with the 2016-2020 Five-Year Report, the remedial effectiveness evaluation will be more robust and will more specifically include, as much as practicable, projections to attain regulatory clean-up levels.

Specific Comment 13: *Section 4.4.2, Page 19, First Paragraph – Although not as dramatic as in the "A" aquifer, the decrease in geometric mean concentration of the "B1" aquifer also appears to be leveling off during the reporting period. A subsequent discussion is warranted as to the timeframe to achieve MCL cleanup goals and possible affects to the "A" aquifer TCE concentrations from an upward vertical gradient from TCE-impacted "B1" groundwater. Please revise the Report accordingly.*

Response: Beginning with the 2016-2020 Five-Year Report, the remedial effectiveness evaluation will more specifically include, as much as practicable, projections to attain regulatory clean-up levels. As discussed in early responses to comments, the "A/B1" Aquifer vertical gradient evaluation will also uniquely discuss well pairs, in the context of hydraulic gradient desirability and vapor intrusion concerns.

Specific Comment 14: *Section 4.4.6, Page 20 – The previously discussed issues with the trends in concentration evaluation should be specifically addressed and summarized as they relate to remedial effectiveness during the reporting period.*

Response: The discussion in Section 4.4.6 Concentration Summary will expand to include implications for remedial effectiveness, beginning with the 2016-2020 Five Year Report. The concentration trends analysis will be revised as discussed in early responses to comments.

Specific Comment 15: *Section 4.5, Page 20, First Paragraph – As stated in the text, the plume boundary discussion relates only to the Signetics Site. Accordingly, the figures presented in Appendix D should correspond to the text and address the Signetics Site and not the entire offsite plume. Please revise the figures in the Report to be consistent with the text.*

Response: In light of EPA's subsequent 12 December 2018 suggestion to combine reports for the OOU and Signetics Sites, the Appendix D figures will remain inclusive of both sites.

Specific Comment 16: *Section 4.5.1, Page 20, First Paragraph (and Figures D-1 through D-5) – The 0.005 milligram per liter (mg/L) contour should be dashed at all places where no outlying data constrain plume contours in the "A" aquifer. Specifically, the 0.005 mg/L contour*

near well S033A is not constrained to west or to the north of well 29-S. In addition to the benefit of depicting the regulatory value (0.005 mg/L) extent of the TCE MCL on the "A" aquifer figures, the extent of groundwater exceeding the commercial VISL of 7.4 micrograms per liter (EPA, 2014) should be represented on the figures and discussed in the text. Please revise the Report accordingly.

Response: Dashed isocontours in regions lacking constraining data will be used for annual mapping going forward, and the related discussion will be revised accordingly. The relevant VISL may also be included on the figures and discussed in the text. However, it is expected that isocontours at 7.4 µg/L will not be substantially different from the current contours at 5 µg/L, and would not be useful since all four commercial buildings are already known to overly groundwater exceeding the commercial VISL.

Specific Comment 17: *Section 4.5.2, Page 21, First Paragraph (and Figures D-7 through D-10) – The 0.005 mg/L contour for the "B1" aquifer should be consistently dashed north of wells 52-D and 29-D as no constraining data are present outboard of these wells. Please revise the Report accordingly, and also discuss the lack of constraining data.*

Response: Dashed isocontours in regions lacking constraining data will be used for annual mapping going forward, and the related discussion will be revised accordingly.

Specific Comment 18: *Section 4.5.3, Page 21, First Paragraph (and figures D-11 through D-15) – No "B3" wells are present in the central, western, and southern portion of the Signetics Site to constrain the extent of the TCE plume. Such uncertainty should be expressed in the contours by a dash for the 0.01 mg/L contour and question marks along the 0.005 mg/L contour. Uncertainty in plume boundaries should be discussed in the text. Please revise the Report and figures accordingly.*

Response: Dashed isocontours in regions lacking constraining data will be used for annual mapping going forward, and the related discussion will be revised accordingly.

Specific Comment 19: *Section 4.5.4, Page 21, First Paragraph (and Figures D-16, D- 17, D-19, and D-20) – The extent of the "B4" TCE plume is not constrained by data south and west of well S154B3, a fact that should be reflected as a dash in the 0.005 mg/L TCE contour. In addition, the extent of the 0.005 mg/L TCE contour around well S154B3 is incorrectly placed north of this well. Uncertainty in plume boundaries should be discussed in the text. Please revise the Report and figures accordingly.*

Response: Dashed isocontours in regions lacking constraining data will be used for annual mapping going forward, and the related discussion will be revised accordingly.

Specific Comment 20: *Section 4.6, Page 21 – The evaluation of alternative remedial options with the selection of enhanced anaerobic biodegradation is not justified on the basis of the report content indicating the vertical gradients are acceptable, the capture zones are adequate, the TCE plumes are stable, the mass removal is acceptable, and the TCE concentrations in various aquifers continue to decrease. Please see General Comment #3.*

Response: Beginning with the 2016-2020 Five-Year Report, five-year reports will include findings from the most recent annual capture zone and vertical gradient

evaluation (refer to EPA comments and Locus responses to the 2017 Annual Report with respect to these annual analyses). Ultimately, findings from these analyses in combination with TCE mass removal, concentration, and plume boundary trends will inform a more robust discussion of remedial evaluation, including discussion of *in situ* bioremediation as a potential remedy change.

Specific Comment 21: *Section 5.1, Page 23 – The results of the remedial effectiveness evaluation should be revised to incorporate concerns expressed in the above comments.*

Response: As discussed in previous responses to comments, the remedial effectiveness evaluation going forward will be more rigorous including discussion of any uncertainties that become apparent as a result of that evaluation.

Specific Comment 22: *Section 5.2, Page 23 – Recommendations and modification to the remedial program should include actions to reduce the potential VI concerns in the "A" aquifer, reduce migration of impacted groundwater offsite, and provide a revised schedule of remedial activities and completion. Please revise the Report accordingly.*

Response: As a result of the forthcoming more rigorous remedial effectiveness evaluation, Section 5.2 will include any corresponding recommended actions and modifications to the remedial program.

If you have any questions regarding this correspondence, please call me at (415) 799-9937.

Sincerely,

J. Wesley Hawthorne, PE, PG
President

JWH/njl

cc: (electronic copies)
Shau-Luen Barker, Philips Semiconductors
George Cook, Santa Clara Valley Water District
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